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Pain Experienced by Patients during Periodontal Recall Treatment

Thu-Diem Chung

LOMA LINDA UNIVERSITY
Graduate School

Pain Experienced by Patients during Periodontal Recall Treatment

by

Thu-Diem Chung

A Thesis submitted in partial satisfaction of
the requirements for the degree of
Master of Science in Periodontics

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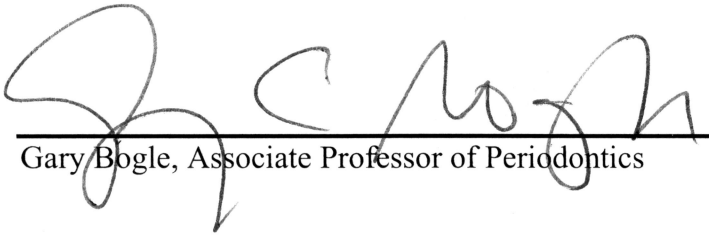
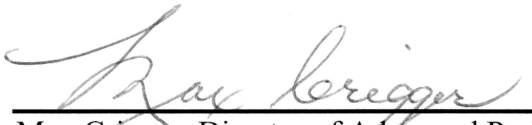
Each person whose signature appears below certifies that this thesis in his/her opinion is adequate, in scope and quality, as a thesis for the degree Master of Science.



, Chairperson

Gary Bogle, Associate Professor of Periodontics



Max Crigger, Director of Advanced Periodontics

Robert Kiger, Chairman of Periodontics

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ABSTRACT OF THE THESIS

Pain Experienced by Patients during Periodontal Recall Treatment

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Thu-Diem Chung

Master of Science, Graduate Program in Periodontics
Loma Linda University, June 2002
Dr. Gary Bogle, Chairperson

The aims of this study were to determine: 1) the degree of pain experienced by patients during probing and debridement; 2) if the treating hygienists could estimate the degree of pain experienced by the patients; and 3) if the patients' pain responses could be predicted by factors such as the patients' age, gender, number of residual periodontal lesions, and the patients' answers to a questionnaire on dental anxiety.

Prior to the maintenance procedures, 2 groups of 20 adult patients to be treated by 2 hygienists completed an anxiety questionnaire. Subsequently, measurements of probing depths were performed, followed by pain ratings by each patient using a Visual Analog Scale (VAS). The hygienists also completed a VAS, estimating the pain level they perceived their patient experienced. The same protocol was repeated for instrumentation (debridement).

The results were as follows: 1) Most patients showed low pain responses to both probing and instrumentation. However, using an arbitrary threshold of VAS $\geq$40 mm, 20-33% of the patients had a significant pain experience. 2) The hygienists were quite accurate in their relative estimates of their patients' pain experiences. 3) Regression

analyses disclosed that significant portions of the pain responses could be predicted by the patients' answers to one of the dental anxiety questions.

In conclusions, recognition of patients that are likely to experience significant pain during periodontal treatment may be facilitated by the use of one question on dental anxiety. During treatment, the ability to gauge and respond to patients' pain experiences would seem to be an important component of the clinical skills of a therapist.

INTRODUCTION

Visits for periodontal maintenance care generally include renewed recordings of probing depths and bleeding on probing, followed by supra- and subgingival debridement of areas with deposits or signs of gingival inflammation. Although the available literature is limited, there is sufficient evidence to document that some patients may find both the probing procedure and the instrumentation quite painful[1-8]. We recently completed a study evaluating the amount of patient discomfort associated with the periodontal maintenance care visits performed in our Advanced Periodontics Clinic[9]. The results indicate that most patients experienced limited pain during both the probing examination and the subsequent debridement. However, we estimated that around 15 percent of the patients reported having a significant pain experience. We also learned that prior recognition of patients that are likely to experience significant pain could be facilitated by the use of a few questions on dental anxiety.

The findings of our study were made in a comparatively small group of patients and in the specific environment of our Advanced Periodontics Clinic. We therefore felt that a similar study of patients' pain responses during routine periodontal maintenance procedures should be performed in a private office setting, to determine if our previous findings could be verified. In addition, the scope of the present study was expanded to determine to what extent the therapist could estimate, from external observations, the degree of pain they thought the patient experienced during the procedures. Thus, the aims of the present study were:

- to determine the level of pain experienced by the patient during periodontal probing and during debridement performed by the dental hygienist at a recall

visit, by asking the patient to place a check mark on a Visual Analog Scale (VAS) for pain evaluation at the completion of the procedures;

- to have an independent appraisal by the hygienist of the pain level she perceived the patient experienced, by asking her to place a check mark on a similar VAS, without verbal communication with the patient during or after the procedures;

to evaluate to what extent the patient's pain responses are related to various factors such as the patient's age, gender, number of residual periodontal lesions, and the patient's answers to a questionnaire on dental anxiety.

MATERIALS AND METHODS

Subjects

40 subjects were selected from among patients previously treated for periodontal disease and under maintenance care at the private periodontal practice of one of the authors (G.B.). Two dental hygienists participated, each treating 20 patients. Adults who were scheduled for a maintenance visit were considered for inclusion. Patient records were reviewed and subjects with 2 incisors, 1 cuspid, and at least 1 premolar and 1 molar in all 4 maxillary/mandibular quadrants were further considered. Patients with any medical or psychological disorder that may affect pain thresholds; patients taking any stress or pain medication; and those patients that previously had required pain control for the maintenance care procedures, including the need for local anesthetic, were not included. Those patients that qualified for the study were contacted by telephone to explain the study design and to inquire about participation in the study during their upcoming maintenance visit. Volunteering patients were asked to arrive 30 minutes earlier than their scheduled appointment in order to fulfill the study procedures.

Characteristics of the 2 groups of patients treated by hygienist 1 and hygienist 2 are presented in Table 1. Approval for the study was granted by the Institutional Review Board at Loma Linda University.

Procedures

At the maintenance visit, the patients received additional verbal information about the study and were given an informed consent to read and sign before their participation. Relevant patient information was recorded. The patients were asked to complete a

questionnaire consisting of 7 questions relating to dental anxiety (see appendix). The patients were also assured that their VAS pain responses would not be disclosed to the treating hygienist.

The treatment procedures were initiated by probing examination of the first arch (maxillary or mandibular), which was alternated among the patients, at 6 sites per tooth using a Hu-Friedy CP-12UNC periodontal probe (tip diameter 0.4 mm). At the completion of the probing, the patients were asked by an assistant to describe the degree of pain experienced during the probing by placing a mark on a 100 mm VAS with end points marked 'no pain' and 'intolerable pain'. At the same time, the hygienist, moving to a separate room, rated the pain level she perceived the patient experienced by placing a mark on a VAS, without knowledge of the patient's VAS recordings. The duration of the probing examination was recorded by the assistant. The hygienist re-entered and carried out the probing examination of the opposing arch (maxillary or mandibular) followed by VAS recordings by the patient and the hygienist.

Subsequently, the same procedures were repeated for the debridement portion of the maintenance therapy. Supragingival calculus was removed and subgingival areas ≥4 mm deep showing bleeding on probing were debrided using hand and/or ultrasonic instruments at the choice of the individual hygienist.

Data Analysis

The VAS responses were measured on the 100 mm lines and expressed as the mm distance from the endpoint 'no pain'. The various analyses used to evaluate the outcome of the present study are indicated under 'Results'. Statistics were performed using

nonparametric tests (Spearman's coefficient of correlation; Wilcoxon signed ranks test; Mann-Whitney U test; and step-wise multiple regression analysis).

RESULTS

Patient characteristics

Characteristics of patients treated by hygienist 1 & 2 are shown in Table 1. The groups were different with respect to % sites ≥4 mm deep and minutes duration of probing. For all other characteristics, there were no differences between the 2 groups.

Patients' pain responses related to order of probing/instrumentation

Mann-Whitney U tests were used to compare the patients' VAS responses to probing and to instrumentation relative to whether the maxilla or mandible was probed and instrumented first or second. The analyses were performed separately for patients treated by hygienist 1 & 2 and separately for maxillary and mandibular arches, comparing subgroups of 10 patients. No significant differences were found relating to the order in which probing and instrumentation were performed (data not presented). Thus, further data analyses were performed without consideration to the order in which both probing and instrumentation were carried out.

Patients' pain responses for maxillary and mandibular arches

Comparisons of the patients' VAS responses to probing and to instrumentation between maxillary and mandibular arches were made using Wilcoxon signed ranks tests. The analyses were performed separately for patients treated by hygienist 1 & 2. No significant differences were observed between arches for either probing or instrumentation (data not presented). Therefore, further data analyses were performed for both jaws combined.

Table 1. Characteristics of patients treated by hygienist 1 & 2. Means ± SD

	Hygienist 1 (N=20)	Hygienist 2 (N=20)
Males/Females†	5/15	5/15
Age†	58.2 ± 10.8	55.6 ± 9.4
Caucasians/Hispanics	19/1	18/2
Non-smokers/Smokers	19/1	18/2
Years of education†	15.2 ± 2.5	14.7 ± 3.1
Years in maintenance†	8.3 ± 5.9	11.6 ± 8.7
Number of recalls last year†	2.6 ± 0.9	2.4 ± 1.0
Number of teeth	27.2 ± 2.0	26.8 ± 2.1
% sites ≥4 mm deep†‡	12.6 ± 10.6	29.6 ± 19.4***
% sites bleeding on probing†‡	14.1 ± 11.1	16.9 ± 12.9
Duration of probing (minutes)	6.3 ± 1.6	9.0 ± 3.0***
Duration of instrumentation (minutes)	28.5 ± 6.2	31.0 ± 8.4

† Variables used for the step-wise multiple regression analyses.

‡ As recorded by the hygienist during the maintenance visit.

*** Significant differences between groups ($P < 0.001$) as determined by Student's unpaired t-test.

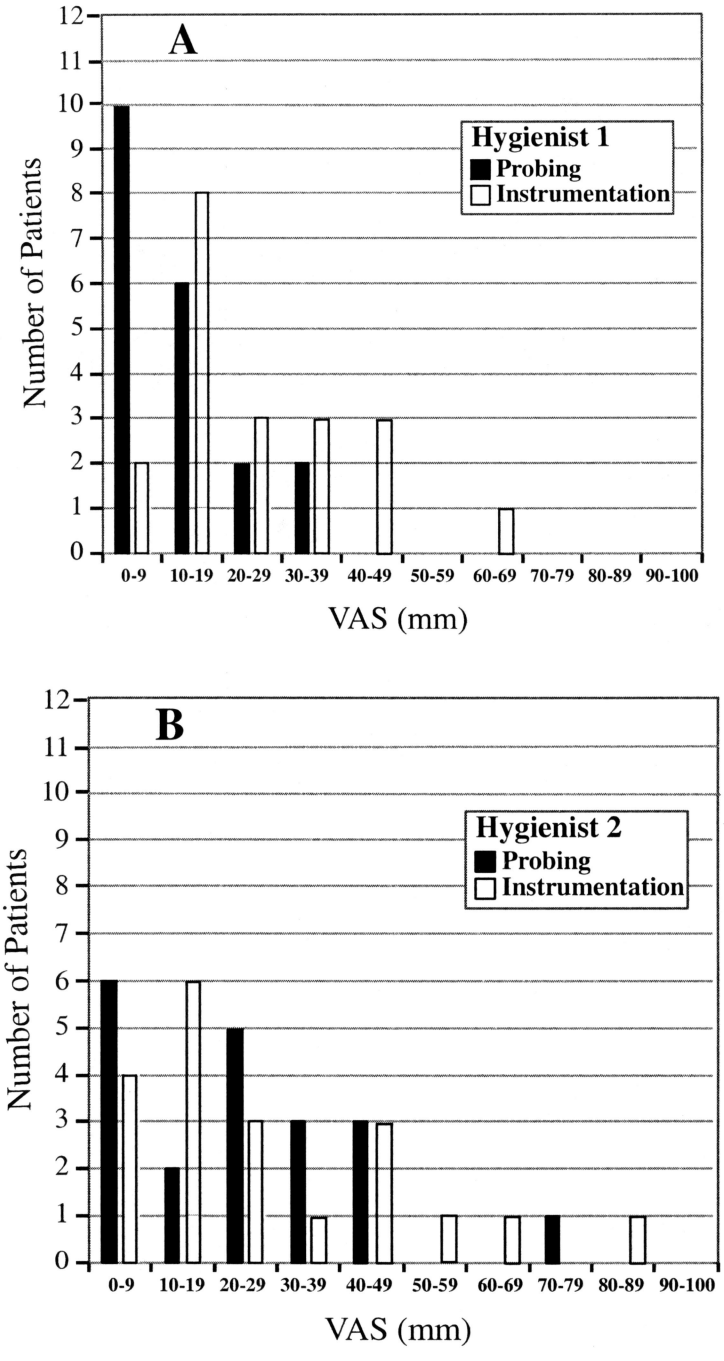
Patients' pain responses to probing/instrumentation for hygienist 1 & 2

Frequency distributions of the patients' pain responses to probing/instrumentation for patients treated by each of the 2 hygienists are presented in Figs. 1A & 1B. Most of the patients of hygienist 1 showed low VAS ratings for probing; however, for instrumentation, more patients had higher VAS responses. Patients of hygienist 2 showed more comparable distributions of pain responses to the 2 procedures. Following instrumentation, there were 4 patients treated by hygienist 1 and 6 patients treated by hygienist 2 with VAS responses above 40 mm.

Median responses to probing/instrumentation for patients treated by each of the 2 hygienists and results of statistical comparisons are presented in Table 2. The analyses confirmed the observations from the frequency distributions, showing that there was a lower pain response following probing for hygienist 1 as compared to the other 3 VAS responses evaluated.

Relationships between patients' pain responses to probing and instrumentation

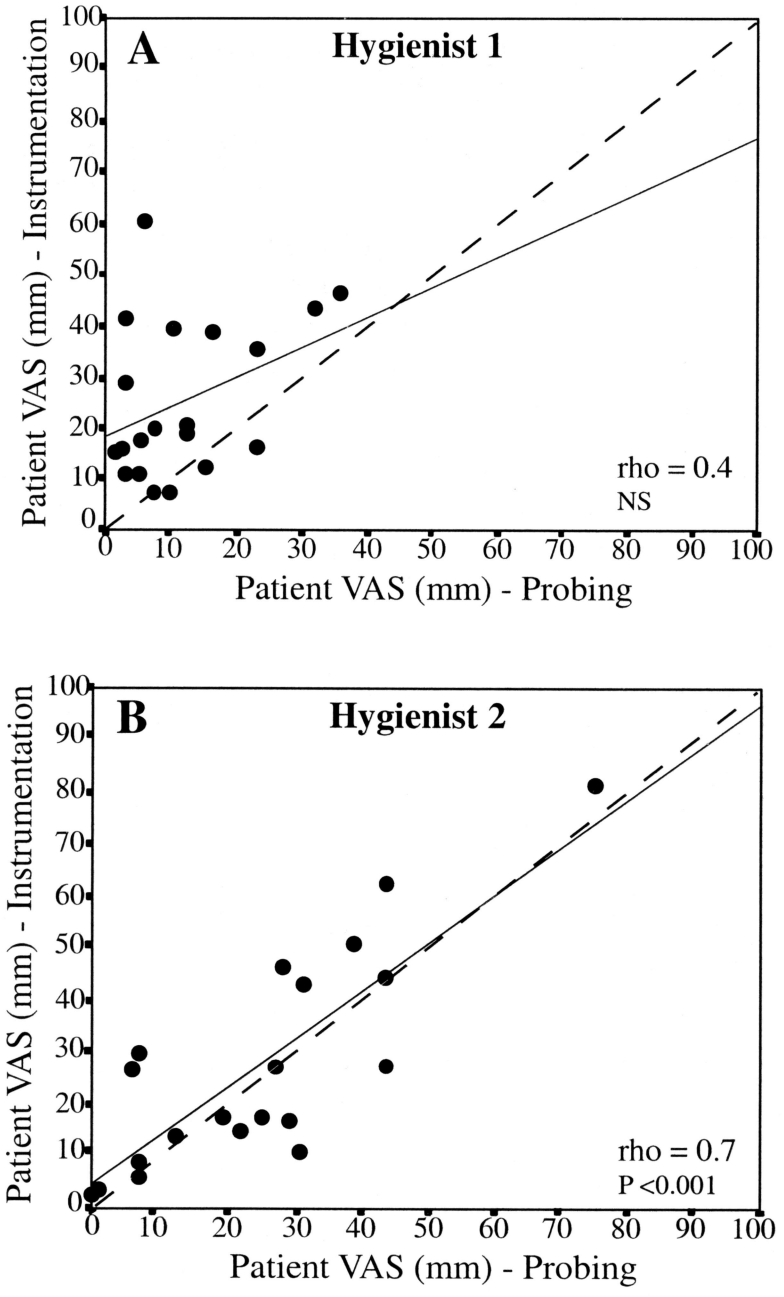
The relationships between the patients' VAS responses to probing and VAS responses to instrumentation are presented in Figs. 2A & 2B. Patients of hygienist 2 showed a close relationship in their responses to the 2 procedures (Spearman's rho = 0.7; $P < 0.001$). Patients of hygienist 1, however, showed a weak relationship in their responses to the 2 procedures (Spearman's rho = 0.4; NS). This weak relationship seems to be related to the low responses to probing for patients of hygienist 1, causing clustering of the data (Fig. 2A).



Figures 1A-1B. Frequency distributions of the patients' VAS pain responses to probing and to instrumentation for each of the 2 hygienists

Table 2. Median and (interquartile ranges) for patient VAS responses to probing and to instrumentation for patients treated by hygienists 1 & 2. Results of statistical comparisons using Wilcoxon signed ranks tests for comparing probing to instrumentation for each of the hygienists, and Mann-Whitney U tests for comparing probing and instrumentation between the hygienists

	Probing Patient VAS (mm)		Instrumentation Patient VAS (mm)
Hygienist 1	9.0 (3.5 – 16.3)	P <0.001	19.5 (13.3 – 39.4)
	P <0.05		NS
Hygienist 2	26.8 (7.0 – 37.1)	NS	22.3 (11.8 – 44.1)



Figures 2A-2B. Scatter plots (including a hatched diagonal line and a solid regression line) of the relationships between the patients' VAS responses to probing and to instrumentation for each of the 2 hygienists

Relationships between patients' and hygienists' pain responses

The relationships between the patients' and the hygienists' VAS responses to probing/instrumentation are presented in Figs. 3A-3D. Three out of the 4 comparisons showed close relationships (Spearman's rho = 0.6-0.8; P <0.01). One of the 4 comparisons - the VAS responses to probing in patients treated by hygienist 1 - showed no relationship (Spearman's rho = 0.1; NS). This once again seems to be related to the low responses to probing for patients of hygienist 1, causing clustering of the data (Fig. 3A). The scatter plots of Figs. 3A-3D also illustrate that hygienist 1 tended to underestimate her patients' pain experiences, while hygienist 2 tended to overestimate her patients' pain experiences.

Relationships between patient characteristics/questionnaire answers and patients' pain responses to probing/instrumentation

Step-wise multiple regression analyses were performed using patient characteristics indicated in Table 1 and the answers to each of the 7 dental anxiety questions listed in the appendix as independent variables and VAS responses to probing/instrumentation as dependent variables. The analyses were performed for combined patient groups of hygienist 1 & 2. Results of these analyses were as follows:

VAS probing as dependent variable: Dental anxiety question number 2 and % sites ≥4 mm entered the equation, accounting for 33% of the variance (Table 3).

VAS instrumentation as dependent variable: Dental anxiety question number 2 and % sites bleeding on probing entered the equation, accounting for 47% of the variance (Table 3).

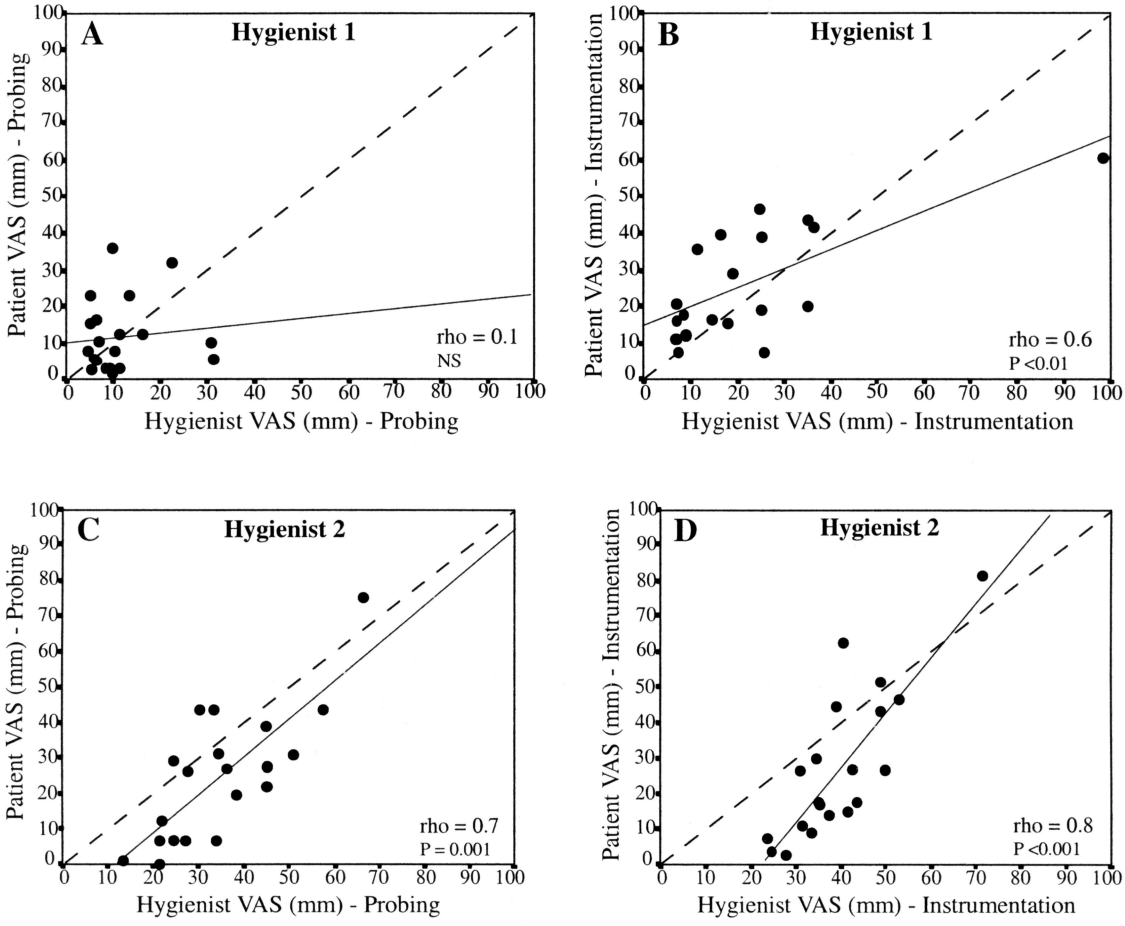


Figure 3A-3D. Scatter plots of the relationships between the patients' and the hygienists' VAS ratings to probing and to instrumentation

Table 3. Results of step-wise multiple regression analyses. The data were rank-ordered for the answers to the dental anxiety questions and for the patient VAS responses

Regression 1: Patient VAS probing as the dependent variable

Variables Entered	R	R^2	ΔR^2	ΔF	P
Step 1: Dental anxiety question number 2	0.48	0.23	-----	11.5	0.002
Step 2: % sites ≥4 mm deep	0.58	0.33	0.10	5.4	0.025

Regression 2: Patient VAS instrumentation as the dependent variable

Variables Entered	R	R^2	ΔR^2	ΔF	P
Step 1: Dental anxiety question number 2	0.62	0.38	-----	23.7	0.000
Step 2: % sites bleeding on probing	0.69	0.47	0.09	6.3	0.016

DISCUSSION

The present study on pain experienced by patients during periodontal recall treatment is a duplication of a previous study of ours[9], to determine if our previous findings could be verified. Some modifications of study design were introduced, including:

1. Methods of pain assessment: In our previous study, in addition to VAS pain ratings, we used a tallying device that the patients activated every time they experienced pain ('pain frequency recordings'). We found that the 2 methods for pain assessments were related, and therefore decided to use VAS recordings only for the present study.
2. Questionnaire on dental anxiety: In our previous study, the questionnaire included a total of 25 questions on dental anxiety. We found that 7 out of the 25 questions showed a relationship to the pain responses following probing and/or instrumentation. Therefore, in the present study, the questionnaire was limited to these 7 questions.
3. Probing force: A standardized probing force was used in our previous study. In the present study, we elected not to use a standardized force, allowing the hygienists to adjust the probing force to the various conditions, as they would normally do.
4. Aims of study: The scope of the present study was expanded to determine to what extent the therapist could independently estimate the degree of pain that the patients experienced during the procedures.

Patients treated by hygienist 1 had significantly less % sites ≥4 mm deep as compared to patients treated by hygienist 2. This difference may, in part, explain why the patients' VAS responses to probing were lower for hygienist 1 than for hygienist 2. More likely, however, the difference was due to hygienist 1 using a more gentle approach during probing, perhaps with less apical penetration of the probe, which in turn resulted in recording of fewer sites ≥4 mm deep.

In our previous study, the patients' pain responses to probing tended to be higher than the patients' pain responses to instrumentation for both of the 2 participating hygienists. This may have been related to the fact that a standardized probing force of 0.50 N was used, which did not allow the hygienists to adjust the probing force to their own routines. In the present study, a standardized probing force was not used, presumably allowing hygienist 1 to apply her customary, more gentle probing, and thus explain why the patients' VAS responses following probing for hygienist 1 were found to be comparatively low.

Most patients of the present study showed low pain responses to both probing and instrumentation. However, following probing, there were 4 patients of hygienist 2 with VAS ratings above 40 mm. Following instrumentation, there were 4 patients of hygienist 1 and 6 patients of hygienist 2 with VAS responses above 40 mm. It is, of course, difficult to determine what constitutes a significant pain experience, considering the nature of these measurements. Nevertheless, using the above arbitrary threshold of VAS 40 mm, our results indicate that 20% of the patients of hygienist 2 found probing quite painful, while 20% and 33% of the patients of hygienist 1 & 2 respectively found

instrumentation quite painful. In our previous study, using the same arbitrary threshold, we found that around 15% of patients found probing and/or instrumentation quite painful.

For hygienist 1, there was a limited, nonsignificant relationship between the patients' responses to probing and their responses to instrumentation (rho = 0.4), perhaps related to the patients' overall low VAS ratings to probing for this hygienist, which resulted in clustering of the data. For hygienist 2, however, a relatively close relationship between the patients' VAS responses to probing and to instrumentation was observed (rho = 0.7). This confirms the findings of our previous study involving 2 other hygienists, in which, patients' VAS responses to probing and to instrumentation showed coefficients of correlation of 0.6-0.7.

As mentioned above, the hygienists of the present study made independent appraisals of the pain levels they perceived their patients experienced by completing VAS ratings following the 2 procedures. For hygienist 1, there was no relationship between hers and the patients' pain assessments following probing. Again, this seems to be due to the patients' overall low VAS ratings to probing for this hygienist, which resulted in clustering of the data. However, following instrumentation, comparison of the ratings by hygienist 1 and by her patients' disclosed a relatively close relationship (rho = 0.6). For patients treated by hygienist 2, for both probing and instrumentation, there were evident associations between patients' and hygienist's ratings (rho = 0.7-0.8). These findings suggest that the participating hygienists were generally quite accurate in their relative estimates of the various pain levels their patients experienced. This ability – to be able to gauge the patients' pain experiences - would seem to be an important component of the clinical skills of a therapist. Several questions emerge relative to this ability: What are the

specific signs expressed by patients that may help therapists to recognize patient discomfort? Is this ability a common feature amongst therapists? If not, can it be learned – and how? It is our impression that these questions have been overlooked in the past.

One of the purposes of the present study was to evaluate to what extent the patients' pain responses were related to various factors such as the patients' age, gender, number of residual periodontal lesions, and the patients' answers to 7 questions on dental anxiety. The results of our step-wise multiple regression analyses showed that one of the questions on dental anxiety (question number 2) was a significant predictor to the patients' VAS responses to probing and to instrumentation, and once this question entered the equation, none of the other 6 questions provided additional predictive power. This confirms the results of our previous study, in which this question also proved to be a predictor of the pain responses. In that study, however, we found that another question (question number 4) offered some additional predictive power.

In our previous paper we wrote: "It would seem that prior recognition of patients that may experience pain can be facilitated by the use of these 2 questions. Consequently, our Advanced Periodontics Clinic has incorporated the combination of these 2 questions on anxiety and the VAS pain responses following probing, referred to as the 'Periodontal Pain Indicator' into the patient chart used for initial examination (Fig. 4). This indicator allows the therapist to recognize the individuals who require especially gentle treatment - and if gentle treatment would compromise the quality of the procedures - who might benefit from some form of anxiety/pain control medication." The results of the present study suggest that the 'Periodontal Pain Indicator' could be limited to the use of 1 of the questions only (question number 2).

The scatter plots and the regression lines of Fig. 5A & 5B, illustrating the relationships between the patients' answers to dental anxiety question number 2 and the patients' VAS responses to probing and to instrumentation, show that an answer rating of 3 ('somewhat anxiety or fear producing') corresponds to VAS responses to probing of about 25 mm and to instrumentation of about 35 mm. It may thus be practical to use answers with ratings of 3 or higher to this question as an alert to potential significant pain experiences by patients.

A model to test the effects of medication on patients' pain levels during periodontal maintenance therapy has emerged from the results of our 2 studies. Patients with elevated pain responses will be identified using the 'Periodontal Pain Indicator'. These patients will then be subjected to a controlled test/placebo study on the efficacy of a given pharmaceutical agent.

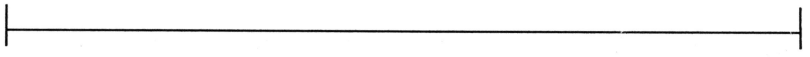
1. How fearful are you of having your teeth cleaned? 1 2 3 4 5 none very much	2. In general, how fearful are you of having dental work done? 1 2 3 4 5 none very much
3. Please mark the line at a position between the two extremes to represent the level of pain that you experienced following the probing procedure  No pain Intolerable pain	

Figure 4. 'Periodontal Pain Indicator'. Items 1 and 2 correspond to questions number 2 and 4 in the appendix.

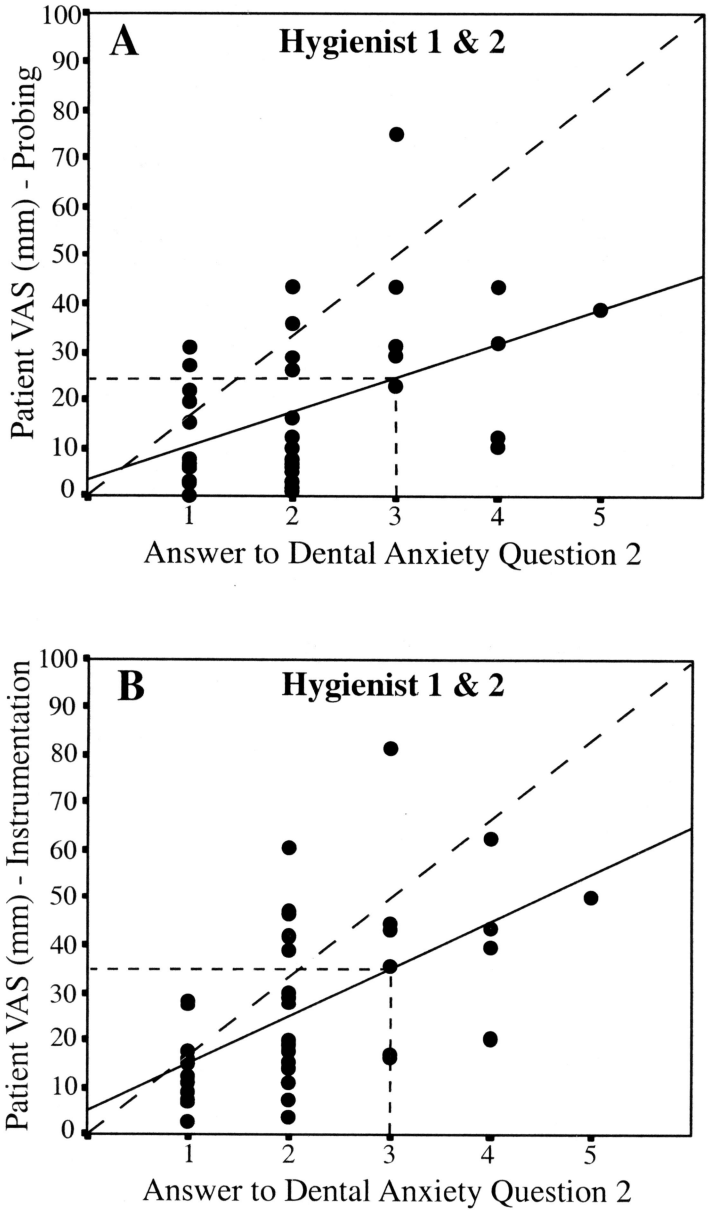


Figure 5. Scatter plots of the relationships between the patients' VAS responses to probing and to instrumentation and their answers to question 2 on the dental anxiety questionnaire. The dotted lines indicate the predicted VAS level corresponding to answer level 3 ('somewhat anxiety or fear producing') to dental anxiety question 2.

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APPENDIX

Dental anxiety questions. Questions 1-3 originate from the Dental Fear Survey[10-11] and questions 4-7 from Corah's Dental Anxiety Scale[12]

Following are 3 items that many people mention as being somewhat anxiety or fear producing. Please, rate how much fear, anxiety, or unpleasantness each of them causes you. Use the numbers 1-5 from the following scale. Make a check in the appropriate space.

1	2	3	4	5
none at all	a little	somewhat	much	very much

	1	2	3	4	5
1. Being seated in the dental chair.....					
2. Having your teeth cleaned.....					
3. All things considered, how fearful are you of having dental work done.....					

Following are 4 other questions that also may help in determining your level of fear, anxiety, or unpleasantness in regards to dental care.

4. If you had to go to the dentist tomorrow, how would you feel about it?
    a. I would look forward to it as a reasonably enjoyable experience.
    b. I wouldn't care one way or the other.
    c. I would be a little uneasy about it.
    d. I would be afraid that it would be unpleasant and painful.
    e. I would be very frightened of what the dentist might do.

5. When you are waiting in the dentist's office for your turn in the chair, how do you feel?
    a. Relaxed
    b. A little uneasy
    c. Tense
    d. Anxious
    e. So anxious that I sometimes break out in a sweat or almost feel physically sick.

6. When you are in the dentist's chair waiting while he/she gets the drill ready to begin working on your teeth, how do you feel?

a. Relaxed
b. A little uneasy
c. Tense
d. Anxious
e. So anxious that I sometimes break out in a sweat or almost feel physically sick.

7. You are in the dentist's chair to have your teeth cleaned. While you are waiting and the dentist or the dental hygienist are getting out the instruments, which he/she will use to scrape your teeth around the gums, how do you feel?

a. Relaxed
b. A little uneasy
c. Tense
d. Anxious
e. So anxious that I sometimes break out in a sweat or almost feel physically sick.
